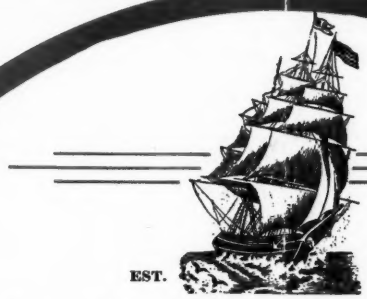
The American Fertilizer

Vol. 93 AUGUST 31, 1940 No. 5



EST. 1850

90 YEARS OF SERVICE

H · J · BAKER & BRO.

271 Madison Ave., NEW YORK

BALTIMORE CHICAGO SAVANNAH TAMPA

Sole Distributors of

DRIED ACTIVATED SLUDGE

SANITARY DISTRICT of CHICAGO

IMPORTERS *EXPORTERS*

POTASH SALTS,

SULPHATE of AMMONIA, NITRATE of SODA, PERUVIAN BIRD GUANO, FISH MEAL, BONE MEAL, TANKAGE, BLOOD, NITROGENOUS,

AND ALL OTHER

FERTILIZER MATERIALS

INTERNATIONAL AGRICULTURAL CORPORATION

MANUFACTURERS OF HIGH GRADE FERTILIZERS

DEALERS IN

FERTILIZER MATERIALS

SUPERPHOSPHATE — MULTIPLE SUPERPHOSPHATE

— OMEGA TANKAGE —

— AMERICAN and FOREIGN POTASH SALTS —

— MINERAL AMMONIATES — TRISODIUM PHOSPHATE —

— COMPLETE FERTILIZERS —

FLORIDA PEBBLE ROCK PHOSPHATE—68%, 70%, 72%, 75%, 77%,

TENNESSEE PHOSPHATE ROCK—72%, 75%, 77%,

Let us quote on your requirements

General Office:
61 BROADWAY
NEW YORK CITY

Southern Headquarters:
ATLANTA, GA.

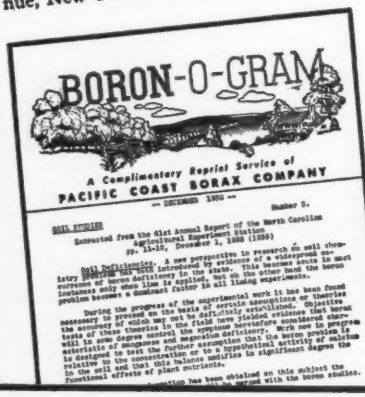
TRADE CROP PRODUCING FERTILIZERS MARK

Phosphate Rock Mines at
MULBERRY, FLA.
MT. PLEASANT, TENN.
WALES, TENN.

Satisfaction at Harvest Time

A Service to Agriculture

Continuing our policy of service to agriculture, we offer to you the Boron-O-Gram, a monthly reprint of scientific Boron literature. May we add your name to our mailing list? Please address: Pacific Coast Borax Company, 51 Madison Avenue, New York City, N. Y.



When Boron is Required

● Supply it with the well-known Twenty Mule Team Borax or Boric Acid. The Twenty Mule Team trade-mark, which has been a standard of quality for 50 years, guarantees these products as being 99½-100% pure.

BORAX and BORIC ACID

PACIFIC COAST BORAX COMPANY, 51 MADISON AVE., NEW YORK CITY - LOS ANGELES, CAL., 510 WEST 6TH ST.

Published every other Saturday. Annual subscription: In the United States, $3.00; Canada and Mexico, $4.00; other countries, $5.00. Entered as second-class matter, January 15, 1910, at the Post Office at Philadelphia, Pa., under Act of March 3, 1879. Registered in United States Patent Office. Publication office, 1330 Vine St., Phila., Pa.

A Complete Service

THE strategic factory locations of the American Agricultural Chemical Company, as shown on the accompanying map, assure prompt, dependable service for the complete line of products listed below.

We manufacture all grades of Commercial Fertilizers, Superphosphate, Agrinite Tankage, Bone Black, Bone Black Pigments (Cosmic Black), Dicalcium Phosphate, Monocalcium Phosphate, Gelatin, Glue, Ground Limestone, Crushed Stone, Agricultural Insecticides (including Pyrox, Arsenate of Lead, Calcium Arsenate, etc.), Trisodium and Disodium Phosphate, Phosphorus, Phosphoric Acid, Sulphuric Acid, Salt Cake; and we are importers and/or dealers in Nitrate of Soda, Cyanamid, Potash Salts, Sulphate of Ammonia, Raw Bone Meal, Steamed Bone Meal, Sheep and Goat Manure, Fish, Blood and Tin-Tetrachloride. We mine and sell all grades of Florida Pebble Phosphate Rock.

FACTORIES

Alexandria, Va.	Detroit, Mich.	Pierce, Fla.
Baltimore, Md.	East Point, Ga.	Port Hope, Ont., Can.
Buffalo, N. Y.	East St. Louis, Ill.	Presque Isle, Me.
Carteret, N. J.	Greensboro, N. C.	Savannah, Ga.
Cayce, S. C.	Henderson, N. C.	Searsport, Maine
Chambly Canton, Quebec, Can.	Montgomery, Ala.	South Amboy, N. J.
	Norfolk, Va.	Spartanburg, S. C.
Charleston, S. C.	No. Weymouth, Mass.	West Haven, Conn.
Cincinnati, Ohio	Pensacola, Fla.	Wilmington, N. C.
Cleveland, Ohio		Havana, Cuba

The AMERICAN AGRICULTURAL CHEMICAL Co.

50 Church Street, New York City

SALES OFFICES

Alexandria, Va.	Columbia, S. C.	Laurel, Miss.	Pierce, Fla.
Baltimore, Md.	Detroit, Mich.	Montgomery, Ala.	Port Hope, Ont.
Buffalo, N. Y.	East Point, Ga.	Montreal, Quebec, Can.	Savannah, Ga.
Carteret, N. J.	East St. Louis, Ill.	New York, N. Y.	Spartanburg, S. C.
Charleston, S. C.	Greensboro, N. C.	Norfolk, Va.	St. Paul, Minnesota
Cincinnati, Ohio	Henderson, N. C.	No. Weymouth, Mass.	Wilmington, N. C.
Cleveland, Ohio	Houlton, Me.	Pensacola, Fla	Havana, Cuba

Ashcraft-Wilkinson Co.

Fertilizer Materials ▲▼ *Cottonseed Products*

DIRECT IMPORTATIONS OF

Nitrogenous Material - Bone Meal
Nitrate of Soda - Potash Salts
Sulphate of Ammonia

South American Blood and Tankage
Foreign Whale and Fish Guano

Exclusive Selling Agents
DUVAL TEXAS SULPHUR COMPANY, HOUSTON, TEXAS

Home Office: **ATLANTA, GA.** CABLE ADDRESS: ASHCRAFT

Offices: NORFOLK, VA., National Bank of Commerce Bldg.; CHARLESTON, S. C., Exchange Bank Bldg.

"TRONA" POTASH

Trona Muriate of Potash is now being used from coast to coast. Uniformity—excellent mixing qualities—prompt deliveries—have contributed to the increasing popularity of this American product.

Manufacturers of Three Elephant Borax and Boric Acid
See Page 23

Branch Sales Offices: Atlanta, Ga.; Baltimore, Md.; Chicago, Ill.; Los Angeles, Cal.

AMERICAN POTASH & CHEMICAL CORPORATION
70 Pine Street New York City

TRONA

...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 93 AUGUST 31, 1940 No. 5

The American Chemical Society

Abstracts of Papers to be presented at the Meeting of the Division of Fertilizer Chemistry at Detroit, Mich., September 9 to 13, 1940

Composition and Properties of Superphosphates. Volatilization of Fluorine in Superphosphate Manufacture

K. D. Jacob, H. L. Marshall, D. S. Reynolds, and T. H. Tremearne, Division of Fertilizer Research, Bureau of Plant Industry, Washington, D. C.

The fluorine content of 27 samples of ordinary superphosphate, manufactured by 24 plants throughout the United States, ranged from 1.22 to 2.01 per cent (average 1.63 per cent). The Florida pebble superphosphates (17 samples) contained 1.41 to 2.01 per cent fluorine (average 1.73 per cent), whereas the Tennessee brown-rock superphosphates (10 samples), contained 1.22 to 1.68 per cent (average 1.47 per cent). As calculated from the respective F : P_2O_5 ratios in the superphosphate and phosphate rock, 10.7 to 37.8 per cent of the fluorine (average 25.5 per cent, or 19.2 pounds of fluorine per 2,000 pounds of rock) was volatilized in the case of the Florida pebble superphosphates, as compared with 28.1 to 42.1 per cent (average 34.2 per cent, or 25.2 pounds of F per 2,000 pounds of rock) in the Tennessee brown-rock superphosphates.

In 12 samples of double superphosphate made from Florida pebble and western phosphate rocks with wet-process phosphoric acid, the fluorine content ranged from 1.65 to 2.68 per cent (average 1.99). The overall loss of fluorine from the rock in the manufacture of these double superphosphates averaged approximately 60 per cent. On the other hand, the fluorine content of 6 samples of double superphosphate made from Tennessee brown rock with wet-process acid ranged from 3.19 to 3.90 per cent (average 3.40 per cent), representing an average overall loss of approximately 30 per cent of the fluorine.

Nine samples of double superphosphate made from Tennessee and Florida rocks with furnace-process acid contained 1.08 to 1.75 per cent fluorine (average 1.43 per cent), representing an average overall loss of approximately 75 per cent of the fluorine in the rock.

Superphosphate Manufacture. Proportioning of Rock Phosphate Dust and Phosphoric Acid

R. L. Copson and R. H. Newton, Tennessee Valley Authority, Wilson Dam, Ala.

In manufacturing concentrated superphosphate by acidulating rock phosphate dust with phosphoric acid, the maximum theoretical yield is one part of P_2O_5 in the dust rendered citrate-soluble for each two parts of P_2O_5 added as acid. When using 70 to 80 per cent phosphoric acid, actual yields are always less than this, chiefly because part of the acid is consumed in formation of phosphates of iron, aluminum, etc., and in the displacement of fluorine compounds. Furthermore, the fraction of P_2O_5 in the rock phosphate dust which is rendered citrate-soluble is not a linear function of the proportion of acid added, apparently because a larger fraction of the acid is consumed in side reaction as the extent of acidulation is increased.

In experiments in which rock phosphate dust containing 33 per cent P_2O_5 was acidulated with 78 per cent phosphoric acid, the maximum yield of citrate-soluble P_2O_5 per unit of P_2O_5 added as acid occurred when not more than 85 per cent of the P_2O_5 in the rock was rendered citrate-soluble.

For these conditions, and assuming that the rock phosphate dust cost $5 per ton and that phosphoric acid costs $75 per ton of P_2O_5, it is shown that the optimum economic proportion of acid is that required to convert about 90

per cent of the P_2O_5 in the rock dust to the citrate-soluble condition. This optimum proportion varies with the cost of dust and cost of acid.

The Oxidation of Phosphorus by Steam

Stephen Brunauer and J. F. Shultz, Fertilizer Research Division, Bureau of Plant Industry, U. S. Department of Agriculture

The oxidation of phosphorus by steam was investigated at 1,000° and 1,100° C. with steam to phosphorus ratios varying from 10.5 to 56. With the ratio of 10.5 considerable quantities of unconverted phosphorus remain in the gas mixture; with ratios of 24 and higher all phosphorus is oxidized. With all ratios the exit gases contain phosphine; the amount of phosphine decreases with increasing steam to phosphorus ratios. The oxidation product is a mixture of phosphorus pentoxide and phosphorus tetroxide; the amount of pentoxide, very unexpectedly, decreases with increasing steam to phosphorus ratios. With a ratio of 10.5 about one-tenth, with a ratio of 56 about one-third of the oxides is the tetroxide.

If the hydrogen is to be used in the synthesis of ammonia the phosphine must be removed since it poisons the catalyst. If the oxide of phosphorus is to be used in phosphate fertilizers, the lower oxide must be removed, since it is harmful to plants. These difficulties are obviated if the oxidation is carried out in the presence of phosphate rock. The pentoxide reacts with the rock to form essentially calcium metaphosphate which contains no trivalent phosphorus. The removal of the pentoxide results in the conversion of the tetraoxide to the pentoxide. At the same time the phosphine is also removed from the gas phase. Other gases are produced in the reaction with phosphate rock, such as H_2F_2, H_2S, etc., most or all of which can be removed from the hydrogen by scrubbing with alkali.

Free Acids in Superphosphate and a Rapid Accurate Method for Making the Determination

Philip McG. Shuey, Shuey & Co., Savannah, Ga.

A conception of the existence of free phosphoric acid in the liquid phase is given; also a simple rapid method is described for determining the total free acids including the phosphoric and the fluorine acids in titration equivalent in terms of phosphoric acid in various extractants.

An observation is made by which it may be predetermined by the initial titration whether fluorine acids are present in the extraction in appreciable quantity. The titration behavior of the common fluorine acids most likely to exist.

Experiments showing the action of HF and H_2SiF_6 on phosphate rock; also, an experiment setting forth that there is no appreciable action of monocalcium phosphate, and therefore the total free acids may be taken as the criterion in furnishing valuable information as to the economic production of superphosphate when the ratio between the free acids and citrate-insoluble phosphoric acid is considered. A comparison is made between the theoretical ratio and the practical ratios that have been found to exist which appear to have a rather wide range of variation. Some study is given to the reason for variations in the ratio, but which appear rather constant for superphosphate made by any given uniform formula and set of conditions.

The formation of free H_3PO_4 from $CaH_4(PO_4)_2$ by lowering the concentration of free acid by repeated extractions with acetone is clearly shown by the analysis of a sample of superphosphate before and after extraction.

On account of the relationship between the residual free acids and the mixing formula, a method is given by which certain analytical data may be used in calculating the mixing formula actually used or the proportion of sulphuric acid and ground phosphate rock as a check on the formula supposed to be employed.

References are given covering the large amount of valuable and important work on the subject.

Factors Affecting the Caking of Fertilizers

J. Richard Adams and William H. Ross, Division of Fertilizer Research, Bureau of Plant Industry, Washington, D. C.

The caking of fertilizers results as a rule from the knitting together of the crystals of which the material or mixture is composed. This knitting together of crystals may occur when a material undergoes a change in crystal form, when a material crystallizes from the solution phase, when new crystals are formed as a result of chemical reaction between the components of a mixture, and when a material combines with the free water present to form a soluble or insoluble hydrated compound.

Ordinary changes in temperature and pressure may influence the rate of setting of water-insoluble hydrates, but these factors have little or no effect on the ultimate hardness of the caked mass. The caking of water-soluble materials by crystallization differs from that which accompanies the formation of insoluble hydrates in that not only the rate but also the extent of caking may be markedly affected by

relatively small changes in temperature and pressure.

The rate and extent to which caking takes place in a fertilizer mixture of the ordinary type will vary with the moisture content, the size of the particles, the applied pressure under which it is stored, the temperature changes during storage, and the time of storage. Data are presented showing the effect of these factors on the relative caking tendencies of different fertilizer materials and mixtures.

Effects of Impurities Upon the Fusibility, Citrate-Solubility, and Hygroscopicity of Calcium Metaphosphate.

G. L. Frear, E. F. Deese, and J. W. Lefforge, Tennessee Valley Authority, Wilson Dam, Ala.

Fertilizer-grade calcium metaphosphate, which is now produced in full-scale units at the TVA Fertilizer Works by reacting P_2O_5 with rock phosphate at high temperatures, has approximately the following composition: 66.3% P_2O_5, 25.2% CaO, 4.5% SiO_2, 1.8% Al_2O_3, 2.1% Fe_2O_3, 0.4% F. The product is vitreous unless it contains an excess of CaO, in which case it is partly crystalline due, presumably, to the formation of some $Ca_2P_2O_7$. When the product carries an excess of P_2O_5 it is somewhat hygroscopic, and, in practice, ground limestone is added to prevent caking.

Laboratory studies are reported on changes in fusibility, citrate solubility, hygroscopicity, and tendency to crystallize when additions of P_2O_5, CaO, SiO_2, Al_2O_3, and Fe_2O_3 are made to pure calcium metaphosphate.

Availability of Phosphates. What the More Recent Literature Discloses and What It Lacks

Arthur M. Smith, Synthetic Nitrogen Products Corp., New York, N. Y.

The availability of the mineral phosphorus compounds in fertilizers is a matter of great importance to farmers and to fertilizer manufactures individually and collectively. The mineral phosphate compounds now sold to farmers in fertilizer materials and in mixed fertilizers include mono-, di-, and tri-calcium phosphates, mono- and diammonium phosphates, magnesium ammonium phosphate, potassium phosphates, and others.

Although many field comparisons have been made, chiefly between pulverized raw phosphates, superphosphates, and concentrated superphosphates, the research work on the economically and potentially important mineral phosphorus compounds is insufficient and inconclusive because it does not compare these compounds on a sufficient number of the important crops on the major soil types in the important fertilizer-consuming states.

Economies in the transportation and handling of ammonium and potassium phosphates, and the possibilities of combining by-product ammonia with phosphorus at the coke ovens make apparent the importance of more extensive comparisons. It is desirable further to reduce or eliminate carrier elements of little value so that the definitely needed quantities of secondary and trace elements can be included without sacrificing concentration of the primary plant-food elements.

The variations in yields obtained when identical quantities of the same fertilizer are applied by different methods, and particularly when fertilizers in aqueous solution are applied either as "starter-solutions" or as side-applications indicate that a considerable part of the experimental work should be conducted under field conditions with related chemical studies, on crops that take the larger part of the fertilizer used in each important consuming state.

The Effect of Magnesium Oxide on the Chemical and Physical Properties of Mixed Fertilizers

C. W. Whittaker, K. V. Zahn, and L. F. Rader, Jr., Division of Fertilizer Research, Bureau of Plant Industry, Washington, D. C.

Prior to 1938 magnesium oxide, as such, was not used to any important extent as a source of magnesium for plant nutrition. Since that time, however, increasing amounts of active magnesium oxide have been employed to supply the magnesium requirements of mixed fertilizers. This increase has been due to a number of factors, among which may be mentioned the reduction of available supplies of calcined kieserite and the development of processes in this country that are capable of producing a magnesium oxide suitable for fertilizer use.

The present study is a continuation of the preliminary work on the effect of adding active magnesium oxide to fertilizers as reported at the Boston meeting of the Fertilizer Division.

Chemical tests indicate that the magnesium of active magnesium oxide is available to plants when used in fertilizer mixtures containing superphosphates, and that the greater part of the added magnesium oxide becomes water-soluble. This water-solubility, however, decreases somewhat with increasing time of storage. Much less solubilization of the magnesium oxide takes place when the phosphorus is supplied as dicalcium phosphate. Boiling the sample increases the solubility of magnesium oxide in fertilizer mixtures by an amount

ranging up to 50 per cent over that obtained on washing with cold water. In general, increasing the proportion of magnesium oxide decreases the water-solubility of the phosphorus if the latter is derived from superphosphate. It is estimated that the heat developed on adding 1 per cent of magnesium oxide to a mixture containing superphosphate is sufficient to increase the temperature of the mixture about 35° C. The corresponding heat developed in ammoniated mixtures is about twice as great as in nonammoniated mixtures.

A Rotary Cooler for Ammoniated Fertilizers

E. F. Hartford and F. G. Keenen, E. I. duPont de Nemours & Co., Wilmington, Del.

Design data for a comparatively small, low-cost, rotary cooler have been developed for cooling ammoniated mixtures. It was found that approximately one-half of the heat was removed by vaporizing between 0.5 to 1.0 per cent moisture. The balance of the heat was removed by transfer to the air resulting in a total drop of 40° to 60° F.

The design factors are air to material ratios, air velocities in the cooler shell, air and material temperatures, and water vaporization. Cooler dimensions may be expressed by $A L^{0.55} = K$; A being cross-section area in square feet per ton fertilizer per hour; L being length in feet; and K being constant of heat transfer efficiency. Calculations are shown for a typical unit capable of cooling 30 tons fertilizer per hour.

Fertilizer storage at reduced temperatures allows larger amounts of ammoniating solutions to be used, reduces reversion of available phosphoric acid, improves physical condition, and reduces caking.

On the Concept of "Available" Nutrients in the Soil

S. R. Dickman

Although Dyer in 1894 was the first to use the term "available" as a label for the ions extracted from the soils by citric acid, the basic assumptions on which this type of work was based are considerably older and go back at least to the time of Liebig and Daubeny. This paper contains an analysis of these assumptions from the operational point of view and the present concept of availability of the nutrients in the soil is criticized because of its general vagueness, ease of misinterpretation, and lack of logical consistency.

A new term, producibility, and an old term, availability, are defined operationally:

The producibility of a plant nutrient or other factor concerned in plant growth is the average yield of a particular crop grown under a specified system of soil management in which this nutrient or factor is the only variable, when no other factor has limited the yield.

The availability of a plant nutrient is the total amount taken up by a field crop calculated as pounds per acre in an experiment in which this nutrient is the only variable, when no other nutrient has limited the yield.

The producibility and availability of a plant nutrient will correspond in the range in which this nutrient is the limiting factor, but there might be an increase in its availability in the higher ranges while its producibility would no longer increase or might even decrease. Greenhouse experiments or other methods of measuring these values are acceptable, but only after they have been calibrated with field results. Such concepts as chemical availability, positional availability, etc., no longer are considered as independent variables but are listed as the chemical, positional, etc., factor interdependently affecting the producibility and availability of the nutrient in question.

The determination of the availability of the nutrient elements in fertilizers by chemical methods, of the availability of soil nutrients by solubility studies, or an attempt to simulate root feeding by employing a dilute extracting solution in a soil test are all open to the same criticism. All neglect the soil-plant relationship which of necessity must exist in the growth of a crop. The suggestion of Bray that we should first attempt to determine what form or forms of a nutrient are most closely allied with plant nutrition and, second, try to determine all of that form which occurs in the soil is advocated as the proper function of quick-tests in agricultural science.

The Physiological Basis of Plant Nutrient Deficiency Symptoms

E. E. DeTurk

A fairly large and apparently increasing number of chemical elements is coming to be recognized as necessary, or in some cases beneficial if not essential to the normal growth and reproduction of higher plants. The quantitative requirements of the respective elements vary from minute traces to comparatively large amounts and the concentrations tolerated by plants are limited to a very narrow range with some elements, but extend over wide ranges with others. The toleration of a wide range of concentrations of the major nutrient elements is an important factor enabling plants to adapt themselves to varied soil environments.

(Continued on page 22)

LIEBIG SYMPOSIUM AT AMERICAN CHEMICAL SOCIETY MEETING

The annual meeting of the American Chemical Society will be held this year at Detroit during the week beginning September 9th. Headquarters for the Convention will be at the Hotel Statler. Divisional Meetings will be held in the auditorium of the Masonic Temple.

The Fertilizer Division of the Society is marking in two ways the 100th Anniversary of Liebig's epoch-making paper given before the British Association for the Advancement of Science. One is a Liebig Symposium held jointly with the Divisions of Agricultural and Food Chemistry and the History of Chemistry. Old concepts, along with the very newest ones, will be discussed.

Secondly, there are seventeen other papers covering latest developments in some of the fields opened by Liebig. In those papers, the manufacturer, the chemist and the agronomist will find ideas of special interest to each. Analysis, manufacture, nutrition, and hormones all find a place on the program.

The Liebig Symposium will be held on Tuesday afternoon, September 10th at 2 o'clock. Other meetings of the Fertilizer Division will be held on Monday, September 9th at 9 A. M. and on Wednesday, September 11th, at 9 A. M. and 2 P. M. Abstracts of some of the papers to be presented at these meetings are printed elsewhere in this issue.

Members of the Society are required to pay a registration fee of $3.00. Non-member chemists and chemical engineers are asked to pay an $8.00 registration fee. However, this entitles them to all the privileges and facilities enjoyed at the meeting by the members.

SULPHATE OF AMMONIA PRODUCTION

Figures for the production of by-product sulphate of ammonia and ammonia liquor, compiled by the U. S. Bureau of Mines, show that during July, 60,718 tons of sulphate were manufactured, an increase of 3.8 per cent over June output of 58,514 tons, and of 30 per cent above July, 1939 figures of 46,666 tons. During the first seven months of 1940, production totaled 401,425 tons against 296,572 tons during January-July, 1939.

The production of by-product ammonia liquor was as follows: July, 1940, output 2,358 tons (NH_3 content); June, 1940, output 2,191 tons; July, 1939, output 1,966 tons; January-July, 1940 output 15,843 tons; January-July, 1939 output 12,977 tons.

OFFICIAL GRADES PROPOSED FOR SOUTHWESTERN STATES

The meeting of fertilizer control officials and fertilizer manufacturers of Texas, Arkansas, Oklahoma and Louisiana, held at Shreveport on July 18th, adopted tentatively the list of official grades which are to be sold in those states during the coming fertilizer year.

All four states added nitrogen mixtures of 16-0-0 and 42-0-0. Oklahoma made no other change. Arkansas added as tentative 8-8-8. Louisiana added 10-10-0. Texas dropped 10-20-0 and 15-30-15, and added 8-8-8 and 20-0-0.

The complete list of grades is as follows:

Texas

0-12-4	5-15-5	10-10-0
3-10-3	6-8-4	10-20-10
3-10-0	6-8-8	11-48-0
4-8-4	6-9-3	15-0-14
4-8-6	6-10-7	16-0-0
4-8-10	6-12-6	16-20-0
4-10-0	8-8-8	20-0-0
4-12-4	10-0-10	42-0-0
5-15-0		

Arkansas

0-12-4	4-12-4	10-0-10
3-9-18	5-15-5	10-20-10
3-10-3	6-8-4	15-0-14
4-8-4	6-8-8	16-0-0
4-8-6	6-8-12	42-0-0
4-8-10	6-10-7	Tentative:
4-10-4	6-12-6	8-8-8

Oklahoma

2-12-2	4-8-10	6-10-7
2-12-6	4-12-4	6-12-6
4-8-4	6-8-4	16-0-0
4-8-6	6-8-8	42-0-0

Louisiana

0-12-4	4-8-10	6-12-6
0-14-10	4-10-7	8-8-8
0-15-6	4-12-4	10-0-10
3-8-10	4-12-8	10-10-0
3-10-3	5-15-5	12-8-0
3-10-5	6-8-4	15-0-14
4-8-4	6-8-8	16-0-0
4-8-6	6-10-7	42-0-0

NEW GEAR REDUCER BOOK

Up-to-the-minute information on the complete line of Herringbone Gear Reducers is contained in new Book No. 1519-A, just announced by Link-Belt Company, 307 N. Michigan Ave., Chicago. Addition of several new sizes, and changes in construction, have brought about revisions in both horse power ratings and dimensions.

This new book, which obsoletes Book 1519, will be sent to any interested reader who addresses the company on his business letterhead.

Reducing the Number of Fertilizer Analyses

A Report of the Subcommittee on Fertilizer Ratios of The Committee on Fertilizers of The American Society of Agronomy

Part I—The Economy of a Reasonable Number of Fertilizer Analyses from the Viewpoint of Fertilizer Manufacturers.

The general thought, or attitude, of the fertilizer industry at large on the number of necessary analyses is voiced by the late John J. Watson, past president of The National Fertilizer Association, who stated, "Sound economics and good business demand the manufacture of the fewest number of analyses necessary to meet the real needs of the soil and the crops to be grown."

In a most friendly, helpful, and cooperative spirit, a group of fertilizer manufacturers have contributed confidential facts and figures for the use of the fertilizer ratio subcommittee to promote an understanding of the economics of which the number of analyses plays in fertilizer manufacture. This group of manufacturers operate well over a hundred factories which supply an estimated 45 to 50 per cent of the fertilizer used in the United States, exclusive of the Pacific Coast.

The relationship of number of analyses to cost of fertilizer manufacture is interlocked with numerous other items. These have not been specifically separated by cost accounting methods and consequently, no definite figures are available for the industry as a whole to show the exact range of costs as the number of analyses varies. The figures given are estimates based upon individual records observed by different plant superintendents.

The economy of a reasonable number of analyses in fertilizer manufacture lies in the bagging and shipping phase. Since the greater proportion of the cost of fertilizers is in the materials, the savings in the bagging and shipping are relatively less than if the materials were involved. However, under present day competitive conditions, the manufacturing department heads of the fertilizer industry seek every means to reduce costs without impairing the producing power or packaging of their respective brands. A possible saving of five cents a ton is grasped with enthusiasm.

In bagging and shipping fertilizers, frequent changes of analysis result in the loss of time, reduced production, and increased cost per ton. With each change of analysis, there is necessary delay of the operation of the milling machine for cleaning, for the rearrangement of the line of labor, changing of the automatic scales, and other details. The factory superintendent reduces his costs per ton by keeping the bagging mills in continuous operation. Each delay reduces his output without reducing his labor costs. Consequently, the more analyses demanded in the shipment, the more delay or loss of time.

A bagging mill with a capacity of 20 tons per hour produces 160 tons in an 8-hour day, if running continuously on one analysis. If this machine is delayed at intervals to produce 20 different analyses, it is the estimate of experienced factory superintendents that the production would be reduced to 83.6 per cent and the labor costs would be increased 17.6 per cent. If the same machine is called upon to produce 50 analyses instead of only one, only 60.6 per cent of normal capacity can be produced and the increase in labor costs would be 57.6 per cent.

In a more dramatic manner than the above figures declare the economy of fewer analyses, one of the fertilizer companies relates its experience as follows:

"At one of our plants, we saved out enough straight orders for one brand to operate one of our mills for the entire day without any change or slow down; then, we took, on this same mill, the average list of orders as they were received and made a day's test for a comparison on the two bases of operation. Information developed showed that it cost one-half as much to ship the straight run as it did the regular run."

"Again, we kept accurate time on the operation of three mills at one of our plants on the amount of time actually lost on a day's operation when running orders as received and the information developed showed the loss as equivalent to the shut down of one of the three mills for the entire day. In other words, had we had straight run on one brand without any changes, we could have eliminated one of the three gangs."

Another of this group of manufacturers reports its experience in this manner, "By tak-

ing one week as an average, we found that in shipping 927 tons we changed from one brand to another one hundred and fifteen times—an average of nineteen times a day, and that the average run was eight tons per brand. Each time we changed from one brand to another, we lost approximately eight minutes, allowing for the machine to clean out, and change the men over. In making the one hundred and fifteen changes, we lost exactly fifteen hours—or a day and one-half. Our shipping gang consists of thirty men, with an average labor rate of 42 cents per hour, or $12.60 for the gang hour. Figuring the fifteen hours at $12.60, you will see that we lost about $200.00 during the week. Quite some item when figured over a period of twenty weeks—some $4,000."

The change from car-loadings to truck-loadings, in recent years, intensified the problem of multiplicity of analyses. In car-loadings, the factory superintendent plans his day's production by manufacturing an analysis and assigning the tonnage of this grade to each car on the track. He then changes the mill to make up the second analysis and distributes the same to each car according to the shipping order. At the end of the day, he has loaded as many as 10 to 20 cars without undue loss of time. Under truck-loading, each load must be treated as a unit with all the necessary changes of analyses and consequent loss of time.

Under present conditions, it is a case of increased storage space for bagged goods, or loss of time, labor and power to supply the trucks which appear at the factory without any advance notice.

To accommodate quicker deliveries, due to the change from car-loadings to truck-loadings, some of the fertilizer manufacturers were forced to increase their capital investments for the storage of goods ready for delivery to trucks. Storage space, therefore, must be increased as the number of analyses increases and therefore is a very definite factor in the cost of multiplicity of analyses.

There is, also, a loss in power as there is a loss of labor due to changes in analyses.

The cost of registrations of analyses in some States increases as the number of analyses increases.

To change type for bag printing is another small item of increased cost as the number of analyses increases.

Chemical analyses for control purposes are increased as the number of analyses increases.

The summary of the reports by the various companies reveals that as the number of fertilizer analyses increases there is an increase in cost of production due to loss of time and decreased production in making changes from one analysis to another; increased capital investment for storage; loss of power; cost of registrations; loss of time in printing bags; and more expense in chemical control.

What number of fertilizer analyses could be handled economically by a fertilizer factory? The factory superintendents say 12 to 16. More than that number become burdensome, depending upon the mechanization of the factories and the arrangement of the base piles.

With a smaller number of analyses, more fertilizers could be formulated in complete form prior to bagging, which would reduce human error.

Subcommittee on Fertilizer Ratios:

R. V. Allison, Florida Experiment Station.
F. C. Bauer, Illinois Experiment Station.
H. J. Harper, Oklahoma Experiment Station.
D. D. Long, International Agricultural Corp.
M. H. Lockwood, Eastern States Farmers' Exchange.
J. C. Lowery, Alabama Extension Service.
H. B. Mann, American Potash Institute.
M. F. Morgan, Connecticut Experiment Sta.
Oswald Schreiner, U. S. Dept. of Agriculture.
E. L. Worthen, Cornell University.
C. E. Millar, Michigan State College, Chairman.

DR. N. D. MORGAN JOINS POTASH INSTITUTE STAFF

Dr. N. D. Morgan, horticulturist at the North Louisiana Agricultural Experiment Station, has resigned to join the field staff of the American Potash Institute. In his new position he will carry on the educational program of the Institute in the Southwestern States, cooperating with State and College agricultural forces, the fertilizer trade, and growers, on problems of soil management involving the efficient use of fertilizer.

Dr. Morgan goes to this work well prepared to give excellent service. After his graduation from the Arkansas College of Agriculture in 1930, he studied for his Master's and Doctor's degrees at the Iowa State College of Agriculture, where he specialized in horticulture and plant physiology and conducted the horticultural fertilizer work at one of the Iowa branch stations. For the past two years, he has been located at the Louisiana branch station from which he is resigning.

With headquarters at Shreveport, La., Dr. Morgan will be available for cooperative work in the States of Louisiana, Arkansas, Oklahoma, and Texas.

THE AMERICAN FERTILIZER
ESTABLISHED 1894
PUBLISHED EVERY OTHER SATURDAY BY WARE BROS. COMPANY
1330 VINE STREET, PHILADELPHIA, PA.

A MAGAZINE INTERNATIONAL IN SCOPE AND CIRCULATION DEVOTED EXCLUSIVELY TO THE COMMERCIAL FERTILIZER INDUSTRY AND ITS ALLIED INDUSTRIES

PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

WARE BROS. COMPANY
PUBLISHERS

1330 VINE STREET PHILADELPHIA, PA.
A. A. WARE, EDITOR

ANNUAL SUBSCRIPTION RATES

U. S. and its possessions, also Cuba and Panama.....$3.00
Canada and Mexico..... 4.00
Other Foreign Countries 5.00
Single Copy..... .25
Back Numbers..... .50

THE AMERICAN FERTILIZER is not necessarily in accord with opinions expressed in contributed articles that appear in its columns. Copyright, 1940, by Ware Bros. Company.

Vol. 93 AUGUST 31, 1940 No. 5

Principal Articles in This Issue

PAGE

THE AMERICAN CHEMICAL SOCIETY 5

Liebig Symposium at American Chemical Society Meeting 9

Official Grades Proposed for Southwestern States 9

REDUCING THE NUMBER OF FERTILIZER ANALYSES 10

Estimated Cash Farm Income for 1940 Increases 12

Chilean Nitrate Situation 13

THE CASE FOR COOPERATIVES 14

FERTILIZER MATERIALS MARKET:

New York 15

Baltimore 15

Atlanta 17

Chicago 18

Philadelphia 18

Tennessee Phosphate 20

Estimated Cash Farm Income for 1940 Increases

Present prospects are for a total cash farm income, including Government payments, of about $8,900,000,000 in 1940, the Bureau of Agricultural Economics reported August 23rd in its monthly analysis of the farm income situation. This is about $360,000,000, or 5 per cent, higher than in 1939, and will be the second highest for any year since 1930. In 1937 cash farm income, including Government payments, totaled $9,111,000,000.

This tentative estimate of farm cash income for 1940 includes income from farm marketings and commodities placed under loan, and from Government payments. It is based upon income received in the first 7 months of 1940 and prospective marketings and prices during the last 5 months of the year. In estimating the trend of prices for the remainder of 1940, continuation of the war in Europe was assumed and allowance was made for some further improvement in consumer demand for farm products. The estimates of prospective marketings were based upon the August 1st forecast of production for crops, the number of livestock on farms likely to be marketed during the remainder of the year, and the probable volume of dairy and poultry production.

The total value of products retained on farms for home consumption in 1940 probably will be slightly higher than in 1939, when it totaled $1,229,000,000. The low price of hogs probably has been more than offset by higher prices of dairy products and fruits and vegetables. Gross farm income, including Government payments, in 1940 is expected to total about $10,150,000,000, compared with $9,769,000,000 in 1939. The estimates of gross and cash farm incomes, including Government payments, for 1936 through 1940 are as follows:

Calendar year	Cash farm income and Government payments Million dollars	Gross farm income and Government payments Million dollars
1936	8,499	9,915
1937	9,111	10,569
1938	8,072	9,362
1939	8,540	9,769
1940[1]	8,900	10,150

[1] Tentative estimate.

Government payments in 1940 may be slightly smaller than in 1939, when they totaled $807,000,000.

During the first 7 months of 1940 cash income from farm marketings totaled $359,000,000 more than in 1939, and Government payments have been about the same as in 1939. It

now seems probable that cash income from farm marketings in August will total higher than in 1939, but income during the remainder of the year may not be greatly different from that of a year earlier, because of the marked rise in prices last year following the outbreak of the war in Europe.

Chilean Nitrate Situation

The nitrate of soda situation has changed rapidly during the past few months because of the turn in events in the European war, according to a reliable source of information. Soon after the outbreak of the war last fall, orders for increased quantities of nitrate were received; and as larger purchases continued into 1940, the industry looked for a better year than it had had for some time. Now, however, the outlook is different. Uncertainty exists as to future orders for nitrate since German occupation of Norway and the Low Countries, which has deprived Chile of important markets. Even if orders are received, the shipping facilities, which already are exceedingly difficult, may dwindle to almost nothing. In the past, Chilean nitrate has been carried by foreign ships in about the following percentages: Norwegian vessels, 60 per cent, British, 25 per cent, Greek, 10 per cent, and all others, 5 per cent. The Norwegian ships are now tied up. British ships are occupied otherwise and may be able to move only small quantities at best. Other shipping facilities are inadequate to handle the traffic to Europe. American ships probably would be able to handle shipments to the United States and Hawaii.

In the first 5 months of 1940 exports of nitrate aggregated 846,901 metric tons, compared with 781,857 tons in 1939. Chilean consumption also was greater—8,164 tons in the first 5 months of 1940, compared with 5,721 tons in 1939.

The improved outlook at the outset of 1940 caused one company to recommission two of its plants near Iquique, which have been closed since 1930. The first of the plants now produces 8,000 tons and the second, 3,000 tons. This same company also began to recondition a plant near Antofogasta, which had been inoperative for 15 years. Production capacity was expected to be 5,000 tons per month. However, on June 17th, because of the war, the plant owners announced that they had definitely abandoned their plans to reopen the plant. Up to the present there has been no indication that the two recommissioned plants near Iquique will be closed again; but the Provincial Labor Inspector of Iquique was notified in June that two other nitrate plants on the Iquique pampa would be closed on July 31, 1940. These plants were said to have been producing 100,000 tons of nitrate per annum. They gave work to about 2,400 men.

Continental United States, the Hawaiian Islands, Egypt, Brazil, and Japan have accounted for most of the increased purchases of Chilean nitrate in 1940. Also, it has been reported that there has been a greater market in Spain this year than there has been for several years, but now the shifting of the war zone to the Mediterranean will make changes.

AMERICAN CYANAMID PROMOTES R. M. BANKS

Reginald M. Banks has been appointed Assistant to the President of the American Cyanamid Co. to promote the coordination of research and sales activities, according to an announcement made by the company.

Mr. Banks came to Cyanamid in 1928 from Nitrate Agencies Co., a subsidiary of W. R. Grace & Co. He has recently been manager of the Organic Chemical Sales Department of American Cyanamid & Chemical Co.

Walter T. MacAdam has been appointed to fill the post left vacant by Mr. Banks' promotion.

AAA LIME AND SUPERPHOSPHATE

Use of lime and superphosphate by farmers participating in Conservation program in 32 States is reported as of August 16th in Department of Agriculture release, August 26th: liming materials, 2,502,571 tons; concentrated superphosphate, 164,296 tons; 20 per cent superphosphate, 93,254 tons. East Central region including Delaware, Kentucky, Maryland, North Carolina, Tennessee, Virginia, West Virginia, accounted for 111,536 tons of concentrated superphosphate, 71,011 tons of superphosphate, 973,238 tons of liming materials.

RATE FOR COTTON LOANS

Cotton loans will be available to the cooperators of the AAA at a rate which will vary from a maximum of 9.90 cents a pound in the Carolina mill areas to 9.16 cents in west Texas and New Mexico, 9.80 cents a pound at Gulf and Pacific ports. The rate is based on 15/16 middling cotton, net weight basis, with differentials for grade, staple, and location.

The Case for Cooperatives

By W. G. WYSOR

General Manager, Southern States Cooperative

EDITOR'S NOTE. In our issue of August 3, 1940, we quoted from a letter written by R. B. Douglass, vice-president of Smith-Douglass Co., Inc., Norfolk, Va., to the editor of the "Ledger-Dispatch" of that city and published in their July 23rd issue. In order to present both sides of the "cooperative" picture, we are glad to publish the answer to Mr. Douglass' contentions, which was prepared by W. G. Wysor, General Manager of Southern States Cooperative, one of the largest cooperative associations in the country, which operates a large modern fertilizer plant at Norfolk.

In his recent article, Mr. Douglass makes the mistake, so common with business men, of confusing consumer cooperation with farmer or producer cooperation. He quotes at great length some of the philosophy of the Cooperative League of the U. S. A. That is an organization of Consumer Cooperatives—of urban cooperative groups organized to buy consumer goods. There are very few consumer cooperatives in this country. There are none, so far as I know, in Virginia. The program and purpose of the consumer cooperative movement is utterly foreign to agricultural cooperatives.

Farmer cooperatives are owned, controlled and operated by farmers. There are two types of farmer cooperatives—purchasing associations and marketing associations. Often the same association performs both functions. Mr. Douglass concedes that there is a real need and justification for cooperative marketing but he has no use for purchasing cooperatives.

In the face of urgent need to protect their standard of living, farmers have set up in Virginia and in practically every other state in the union purchasing cooperatives aimed at (1) securing farm production supplies of dependable, guaranteed quality, (2) reducing the cost to farmers of such supplies to a fair basis and (3) the coordination of enough farmers' purchasing power to, by the forces of competition, make it necessary for all sources of farm supplies to operate on reasonable profit margins.

Mr. Douglass leaves the distinct impression that such cooperatives seek to destroy the profit or capitalistic system. Nothing could be further from the truth.

The very purpose of agricultural cooperatives is to make the profit system work better—*for farmers.* Collectively farmers are the largest capitalists in this country. More capital is invested in agriculture than in any other industry. How obviously ridiculous is any contention that farmer cooperatives seek to destroy the capitalistic system!

Farming is a very large business. It has long been, and still is, an unprofitable business. No right thinking person challenges either the right or the need of farmers to take an important part—a pace-setting part if they can—in the performing of services for themselves that are necessary to their farming operations and that have a vitally important bearing on the success of their farming enterprise as a means of livelihood.

No farmer that I know of wants a cooperative monopoly. He thinks of his purchasing cooperative as a pace-setter for private business and he wants to put through his cooperative association just enough business to operate it efficiently so that it can, by competition, make

(Continued on page 26)

BRADLEY & BAKER

FERTILIZER MATERIALS - FEEDSTUFFS

AGENTS - IMPORTERS - BROKERS

155 E. 44th Street
NEW YORK

BRANCHES

Clinton St. & Danville Ave.
Baltimore, Md.

505 Royster Building
Norfolk, Va.

1252 West Beaver Street
Jacksonville, Fla.

FERTILIZER MATERIALS MARKET

NEW YORK

Base Price on Nitrate of Soda Unchanged but Bagging and Hauling Charge to Increase Shortly. Sulphate of Ammonia at a Premium for Immediate Delivery.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, August 27, 1940.

Outside of the issuing of prices on nitrate of soda for September delivery, which remain unchanged at $27.00 in bulk, $28.30 in 200-lb. bags and $29.00 in 100-lb. bags, there has been very little of interest to report in fertilizer materials. In addition to the above September quotation for nitrate of soda, the Chilean Nitrate Sales Corporation have also announced that from October, 1940, through June, 1941, bagged charges on nitrate of soda will be increased 50 cents per ton. This 50 cents per ton will apply both on 100-lb. package and 200-lb. package. Further, charge covering hauling expense to the farm where delivery is accepted at nearest railroad station will be increased from 50 cents to 75 cents per ton. These new delivered prices will also have reduction of 5 cents per ton representing decreased wharfage and handling charges made by railroads at port.

It is believed that producer-agency contracts for the 1940-1941 fertilizer year will be in the hands of the trade shortly.

Sulphate of ammonia is still scarce, but some large parcels were assembled for export within the last ten days. At the moment export demand seems to have quieted down but this is probably simply a temporary lull.

Fertilizer manufacturers have started to take deliveries of muriate of potash and heavy shipments against contracts have been reported.

Dried Blood

Domestic is offered at $2.15 ($2.61½ per unit N), New York, with very little interest either for the domestic or for the imported material at the moment, although seller's ideas on imported material have changed a trifle.

Fish Scrap

Sales of menhaden have been reported at $3.10 ($3.77 per unit N) and 10 cents. There have been no offerings of Japanese sardine meal.

Sulphate of Ammonia

Schedule price is unchanged but domestic buyers in many cases are still willing to pay a premium to obtain deliveries of this material.

Superphosphate

Deliveries are reported as favorable, with no change in prices against those last reported—$8.50 per ton for run-of-pile.

BALTIMORE

Manufacturers Covered for Supplies for Fall Season. Sulphate of Ammonia Still Scarce. Potash Supplies Sufficient.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, August 27, 1940.

On the eve of the fall shipping season, there is very little activity in supplies of raw materials, as manufacturers all have their warehouses crowded to capacity and are not in position to take in further deliveries.

Ammoniates.—The market on South American tankage and blood is ruling slightly easier, due to better demand from the Pacific Coast. The nominal market still remains in the neighborhood of $2.75 to $2.80 per unit of nitrogen, but with only a light demand, as is usual at this time of the year.

Nitrogenous Material.—The market on this article is dormant with practically no interest being manifested by buyers. The market continues nominal at $2.55 to $2.65 per unit of nitrogen for domestic goods.

Sulphate of Ammonia.—This material is gradually getting tighter as most of the manufacturers have not been able to cover for their approximated wants, doubtless due to the fact that there is a heavy demand for export at materially higher prices. The list price for domestic consumption is $28.00, but no further supplies are obtainable on this basis and it is reported that sales have been made for ex-

KNOW - - - -

- - TO A CERTAINTY

the number of pounds of raw material for a desired per cent. of plant food in a ton of mixed goods—or find what per cent. of a certain plant food in a ton of fertilizer produced by a specific quantity of raw materials.

No mathematical calculations are necessary. You can find the figures in a few seconds with the aid of

Adams' Improved Pocket Formula Rule

A Great Convenience for the Manufacturer of High Analysis Goods

To make clearer its use, answers to such problems as the following can be quickly obtained:

How much sulphate of ammonia, containing 20 per cent. of nitrogen, would be needed to give 4½ per cent. nitrogen in the finished product?

Seven hundred and fifty pounds of tankage, containing 8 per cent. phosphoric acid are being used in a mixture. What per cent. of phosphoric acid will this supply in the finished goods?

Should the Adams' Formula Rule become soiled from handling, it may be readily cleaned with a damp cloth.

PRICE $1.00
TO BE SENT WITH ORDER.
Special quotations on twelve or more.

Ware Bros. Company

Sole Distributors

1330 Vine Street :: PHILADELPHIA

port, in bags, at $38.00 to $39.00 per ton of 2,000 lb., f.a.s. ports.

Nitrate of Soda.—Importers of the Chilean product have extended into September only price of $29.00 per ton in 100-lb. bags, but beginning October 1st, the price in 100-lb. bags will be $29.50; 200-lb. bags $28.80 and in bulk, $27.00, ex warehouse ports.

Fish Scrap.—Since last report there have been further sales of unground menhaden fish scrap at the equivalent of $3.75½ per unit of nitrogen and 10 cents per unit of B.P.L., f.o.b. fish factory, for shipment "if and when made" and subject to catch. While the price is now more in line, and 50 cents per unit of nitrogen less than opening sales, it is still considered high in comparison with the market on other feeding materials.

Superphosphate.—There is no change and producers continue to quote run-of-pile at $8.00 per ton of 2,000 lb., basis 16%, and $8.50 for flat 16% grade, both in bulk, f.o.b. sellers' works, Baltimore.

Bone Meal.—There is practically no buying interest being manifested in this material, in consequence of which the market continues to be nominally $32.00 to $34.00 for 3 and 50 per cent domestic steamed bone meal, and $31.50 to $32.00 for 4% and 50 per cent South American raw bone meal, c.i.f. Baltimore.

Potash.—The position of the market on this material is quite firm and stocks carried in warehouses by importers have now been disposed of. This, together with domestic productions, are considered ample for season's normal requirements. There is likely to be a shortage of sulphate of potash until such time as domestic manufacturers get under way producing this particular grade.

Bags.—The burlap market is again ruling easy, and is now at its lowest price of the year, being about $103.00 per thousand delivered Baltimore for plain, new, 10-oz., basis 40 cut 54 in., for either fall or spring delivery.

ATLANTA

Sulphate of Ammonia in Heavy Demand for Export. Domestic Needs Well Taken Care Of. Few Changes in Materials Prices.

Exclusive Correspondence to "The American Fertilizer."

ATLANTA, August 26, 1940.

The demand for sulphate of ammonia still continues active for export with supplies far short of the quantity desired to supply this demand. The producers wisely are giving preference to domestic business and for the most part, the home trade has been fairly well taken care of.

Nitrate of soda is unchanged and it is expected that the September price will be the same as August, although no definite announcement has been made as yet. Nitrate of soda, incidentally, will evidently see an increased demand on account of the tight situation prevailing on sulphate of ammonia.

Price changes in the various materials has been rather negligible in recent weeks.

Tankage.—$2.60 ($3.16 per unit N) and 10 cents, c.i.f.

Blood.—$2.60 ($3.16 per unit N), c.i.f.

Fish Scrap.—Menhaden, $3.10 ($3.77 per unit N) and 10 cents, Chesapeake Bay.

Acidulated Scrap.—Nothing offered.

Sulphate of Ammonia.—Supplies limited with heavy demand.

Nitrate of Soda.—Unchanged.

Cottonseed Meal.—Prime 8 per cent, September/October, Memphis, $21.00.

Steam Bone Meal.—3 and 50 per cent, $31.00, c.i.f.

Raw Bone Meal.—4% and 45 per cent, $31.50, c.i.f.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

500 Fifth Avenue, New York

NATURAL

Chilean
Nitrate of Soda

Old Style and Champion
Both Guaranteed
16% NITROGEN

Valuable not only as a source of nitrogen, but also to help maintain the supply of other plant food elements *naturally* blended with it.

Natural Chilean Nitrate of Soda is the only natural nitrate in the world. It's *always reliable.*

CHILEAN NITRATE
Sales Corporation

120 BROADWAY, NEW YORK
RALEIGH, N. C. ATLANTA, GA. JACKSON, MISS.
MONTGOMERY, ALA. COLUMBIA, S. C.
SHREVEPORT, LA. LOS ANGELES, CALIF.

CHICAGO

Fertilizer Organic Market Quiet. Sellers Maintain Prices. Feed Market Lower.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, August 26, 1940.

Conditions in the western ammoniate market are unchanged. Only spasmodic inquiry is coming in, and but few trades reported. Sellers still resist efforts to materially reduce current asking prices, and until the present state of the market changes, prices must be considered largely nominal.

List prices of digester and meat scraps have been reduced to $40.00 per ton and reports indicate that price is not maintained. In consequence the crude feed market is lower, though showing signs of nearby improvement.

Nominal prices are as follows: High grade ground fertilizer tankage, $1.95 to $2.00 ($2.37 to $2.43 per unit N) and 10 cents; standard grades crushed feeding tankage, $2.25 to $2.35 ($2.73½ to $2.85½ per unit N) and 10 cents; blood, $2.30 to $2.35 ($2.79½ to $2.85½ per unit N); dry rendered tankage, 47 to 52½ cents per unit of protein, Chicago basis.

PHILADELPHIA

New Nitrate of Soda Prices Fail to Stimulate Market. Little Activity in Organics Market.

Exclusive Correspondence to "The American Fertilizer."

PHILADELPHIA, August 27, 1940.

Interest in the fertilizer materials market failed to show any improvement with the issuance of the new nitrate of soda prices. During the month of September the old price will be continued, but beginning October 1st and up to June 30, 1941, the price on bagged material will be increased 50 cents per ton. The bulk price is unchanged.

Nitrate of Soda.—Price unchanged for September delivery, but beginning October 1st, the bulk price is $27.00 per ton; in 200-lb. bags, $28.80; and in 100-lb. bags, $29.50.

Sulphate of Ammonia.—Very firm. Export demand continues.

Dried Blood.—Dull. Offerings at $2.25 ($2.73½ per unit N), being made without any interest being shown.

Tankage.—Quiet. Being quoted at $2.20 to $2.25 ($2.67½ to $2.73½ per unit N) and 10 cents.

Bone Meal.—Steady. 1 and 65 per cent at $34.00 to $35.00; 3 and 50 per cent at $33.00

NO FAMINE HERE!

...THANKS TO POTASH FROM NEW MEXICO

WINTER wheat to be profitable must be well fed. Starved soils mean famine crops. It is estimated that a good acre yield of wheat removes 100 pounds of essential plant foods from the soil. Keeping wheat lands fertile means the adequate use of the right grade of complete fertilizer compounded to fit local conditions of soil and climate.

Potash develops larger heads, plumps out kernels, and makes heavier grains . . . helps the production of quality and quantity crops.

Sunshine State Potash is highly regarded by all fertilizer producers because they can depend upon its uniform analysis . . . careful sizing that means easy handling, blending . . . nation-wide delivery system.

HIGRADE MURIATE OF POTASH
62/63% K_2O
Also 50% K_2O Grade
MANURE SALTS
Approximately 30% K_2O

REG. U. S. PAT. OFF.

SUNSHINE STATE POTASH
A PRODUCT OF NEW MEXICO U.S.A.

UNITED STATES POTASH COMPANY, INC., 30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

to $34.00; 4½ and 45 per cent at $34.00 to $35.00.

Superphosphate.—Inactive. Price remains the same.

Potash.—Published schedule prevails.

TENNESSEE PHOSPHATE

Shipments Indicate Record-Breaking Output for 1940. George F. Blackie, Pioneer in Phosphate Development, Dies at Nashville.

Exclusive Correspondence to "The American Fertilizer."

COLUMBIA, TENN., August 26, 1940.

Shipments of phosphate rock are actively under way to fertilizer manufacturers and to farmers for direct application, as well as to electric furnaces at Monsanto and Victor and to TVA at Muscle Shoals, to foundry specialty users and blast furnace makers of high phosphate iron. It looks as if 1940 shipments will run well over the record mark of 1939 in all lines of consumption.

Press reports tell of the start of an Ohio feed grinding mill, having phosphate rock ground in mixtures with muriate of potash alone, and in combination with sulphate of ammonia. These mixtures have been pronounced by several authorities as equal in results, for many fertilizing purposes, to mixtures with superphosphate, and free from the disadvantages frequently arising from the latter. These mixtures have been successfully used in experimental work for the past twenty years or more, in Texas, Kentucky, Wisconsin and many other states, but under the laws of all states, only A. O. A. C. available phosphoric acid can be guaranteed in mixtures, so that the mixture of 300 lb. sulphate, 1,300 lb. rock and 400 lb. muriate (60%), while containing 3 per cent N, 22 per cent P_2O_5, and 12 per cent K_2O, could only be sold in most states on account of the A. O. A. C. inspired laws, as a 3-1-12.

George F. Blackie, retired Chief Engineer of the N. C. & St. L. Ry., died at Nashville on August 22nd from a heart ailment, at the age of 70 years. During the period from 1899 to 1901 he was chief engineer and assistant general manager of the American Phosphate Co. at Mt. Pleasant. He built the railroad, developing the property now belonging to the Victor Chemical Works, and the original plant on the site of the present Hoover & Mason plant.

We was actively connected with the development of all phosphate properties along the N. C. & St. L. Ry., and his studies during the erection of the pioneer phosphate plant and properties at Mt. Pleasant led to many of the developments that have since been made in greater recovery of the brown rock phosphate.

A. O. A. C. TO MEET IN OCTOBER

The Annual Meeting of the Association of Official Agricultural Chemists will be held at the Hotel Raleigh, Washington, D. C., on October 28th, 29th and 30th, according to an announcement by Henry A. Lepper, secretary and treasurer of the Association.

CLASSIFIED ADVERTISEMENTS

Advertisements for sale of plants, machinery, etc., and for help and employment, in this column, same type as now used, 60 cents per line, each insertion.

POSITION WANTED

WANTED—Location in southeast by experienced, honest, progressive fertilizer man. At home in factory or business end. Address "470," care THE AMERICAN FERTILIZER, Philadelphia.

PULVERIZED MASCOT LIMESTONE
Trade Mark Registered

MAGNESIUM LIMESTONE
"It's a Dolomite"
American Limestone Company
Knoxville, Tenn.

FERTILIZER MATERIALS

■

Let Us Quote You
on Your Requirements of These Materials

- PHOSPHATE ROCK
- SUPERPHOSPHATE
- DOUBLE SUPERPHOSPHATE
- NITRATE *of* SODA
- SULPHURIC ACID
- SULPHATE *of* AMMONIA
- BONE MEALS
- POTASH SALTS
- DRIED BLOOD
- TANKAGES
- COTTONSEED MEAL
- BONE BLACK
- PIGMENT BLACK
- SODIUM FLUOSILICATE

Armour's BIG CROP FERTILIZERS

ARMOUR FERTILIZER WORKS

General Offices: **Walton Building, Atlanta, Ga.**

Division Sales Offices:

Albany, Ga.
Atlanta, Ga.
Augusta, Ga.
Baltimore, Md.
Birmingham, Ala.
Chicago Heights, Ill.
Cincinnati, Ohio
Columbia, S. C.
Columbus, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Houston, Texas
Jacksonville, Fla.
Montgomery, Ala.
Nashville, Tenn.
New Orleans, La.
New York, N. Y.
Norfolk, Va.
Presque Isle, Me.
San Juan, P. R.
Sandusky, Ohio
Wilmington, N. C.

THE AMERICAN CHEMICAL SOCIETY

(Continued from page 8)

In spite of this adaptability symptomatic indications of maladjustments in crop plants have become increasingly prevalent in recent years.

Biochemical studies of normal and affected plants, considered in connection with growth and yield response to soil treatment have contributed to an understanding of the relation between plant symptoms and the disturbances in plant metabolism brought about by malnutrition. The results lead to more accurate diagnosis of plant malnutrition by aid of symptoms.

Some findings reported in this paper are as follows:

1. The most frequently observed cases of malnutrition are those of deficiencies of one or more essential elements, which may be interpreted as excesses of the elements not deficient.

2. Deficiencies are relative; a sufficient supply of an element under one condition becomes insufficient as other elements become more abundant.

3. Deficiency may be due to: (a) insufficient supply in soil; (b) insufficient solubility rate; (c) physiological unavailability, as in failure of "acid sensitive" plants to absorb soluble Ca at low pH; and (d) physiological unavailability within the plant, as failure to reduce absorbed nitrate, preparatory to protein synthesis.

4. There are many kinds of symptoms, roughly grouped into: (a) inhibited growth, no specific symptoms; (b) color symptoms, usually in leaves; (c) necrosis of tissues, usually in leaves; and (d) malformation of different parts of plants.

5. Plant nutrient deficiencies produce symptoms indirectly, the symptoms resulting from a series of physiological processes usually out of balance with respect to their respective rates

6. Being an indirect result, a given symptom may follow more than one original cause, *e.g.*, purple-leaved young corn plants may result from phosphorus starvation, from nitrogen starvation, from a series of cold nights with warm sunny days, or from transverse creasing of the leaves; although the immediate cause of the symptom in the leaf is the same in each case.

7. The manner of expression of a deficiency by symptoms is subject to modification by environmental conditions, as temperature, humidity, etc.; and as a result the same deficiency in a given crop may produce different symptoms in different geographical regions.

Because of the complicated relations existing between plant maladjustments and plant symptoms, the latter may be considered only as diagnostic aids, rather than as diagnostic methods of certainty. As knowledge of the relation between symptoms and fundamental plant processes increases, their diagnostic value also increases.

Comparison Value of Check Fertilizer Analyses

E. W. Magruder, F. S. Royster Guano Company

In 1922 the author started sending to fertilizer chemists a monthly sample of fertilizer for analysis and this work has been continued ever since. The interest in the analyses has increased and there are now sixty-eight chemists analyzing these samples regularly. They are about equally divided between state fertilizer laboratories, commercial fertilizer laboratories, and laboratories of fertilizer manufacturers.

The object of this work may be stated as follows:

1. The average results of so many chemists can be considered as correct so that any chemist, by comparing his results with the average, can tell when he is getting bad re-

NITROGANIC TANKAGE

Let us tell you about this new fertilizer material. We solicit inquiries.

H. J. BAKER & BRO.

271 Madison Ave., NEW YORK

BALTIMORE CHICAGO SAVANNAH TAMPA

WILLIAM E. WELLMANN
BROKER
Baltimore, Maryland

Specializing in

Sulphate of Ammonia
Low Grade Ammoniates
Superphosphate
Sulphuric Acid
Bags

Inquiries and offerings invited

KEYSER BUILDING

DEPENDABLE!

- Large stocks of seasoned materials, available for prompt shipment keyed to your needs.
- Dependable analysis—and every shipment reaches you in good mechanical condition. Write or wire us your next order for

TRIPLE SUPERPHOSPHATE

46 to 48% Available Phosphoric Acid

●

We also manufacture

HIGH-GRADE SUPERPHOSPHATE

U. S. Phosphoric Products Corporation
Tampa, Florida

New York Offices:
61 Broadway
New York, N. Y.

Sales Agents:
Bradley & Baker
155 East 44th St.
New York, N. Y.

A Mark of FLORIDA TRIPLE PHOSPHATE *Reliability*

SPECIFY
THREE ELEPHANT
BORAX

REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.

. . . . WHEN BORON IS NEEDED TO CORRECT A DEFICIENCY OF THIS IMPORTANT SECONDARY ELEMENT

Agricultural authorities have shown that a lack of Boron in the soil can result in deficiency diseases which seriously impair the yield and quality of crops.

When Boron deficiencies are found, follow the recommendations of local County Agents or State Experiment Stations.

Information and references available on request.

AMERICAN POTASH & CHEMICAL CORPORATION
70 PINE STREET, NEW YORK CITY

Pioneer Producers of Muriate of Potash in America

See Page 4

sults and can at once take the proper steps to correct his work.

2. New methods are frequently sent out and the collaborators analyze the sample by both new and old methods to try and determine which is best.

3. Different methods of filtering and different filter papers are checked against each other to determine which is the better.

4. Proposed methods of the A.O.A.C. are frequently sent out for the chemists to use and they thus become acquainted with the methods before they are officially adopted, and are sometimes able to make valuable suggestions for the improvement of the methods.

5. It adds interest to the work of a routine chemist to be able to compare results with sixty-odd other chemists.

The results and methods of many chemists have been greatly improved by analyzing these check samples.

Water Conditioning for Greenhouses. II. Effect of Various Soil Treatments

C. H. Spurway

The alkalizing of greenhouse soils by the carbonates of the hard water when used to water the plants, often results in the production of plants of poor quality and slow marketability. Chlorosis or yellowing of the plant leaves, slow stocky growth with short internodes, and undersized buds and flowers are some of the effects produced on the plants by the continued use of hard water containing carbonates. Other plant growth factors acting with hard water intensify the above-named effects.

There are two general methods of counteracting the effects of hard water on greenhouse plants: (1) conditioning the water by chemical treatments and filtering to neutralize the alkalinity and remove some of the dissolved substances; and (2) treatment of the soil with acid chemicals or fertilizers that leave acid residues in the soil. In this paper attention is given to the effects of fertilizers on counteracting the alkalizing effect of hard water on greenhouse soils, because fertilizers also supply plant nutrients; and with the proper selection of fertilizers the plants can be fertilized and the soil acidified at the same time.

Two soils, one an acid sandy loam (pH 4.8), and the other a sandy loam containing carbonates (pH 6.5) were treated in plats on a greenhouse bench with several fertilizers and acid chemicals, such as are commonly used in greenhouses, in amounts consistent with their practical use on greenhouse soils and in proportion to their acid or acid-forming properties, based on 1.1 pounds of sulphate of ammonia per 100 square feet of bench area. The pH values of the soil under each treatment was taken, by composite sampling, eight times during a period of four months. The amount of water used to keep the soil in a moist condition was also recorded. One-half inch of water was used per week, or a total of 550 gallons containing 1.53 pounds of lime carbonate per 100 square feet of soil.

Comparative effects of the treatments based on the mean pH value for the period:

Carbonate Soil

	Mean pH
Control	7.27
3.0# 0-45-0	6.81
1.2# Ammo.-phos.	6.87
4.1# 5-10-5	6.87
1.3# Urea	6.89
1.1# Sulphate of ammonia	6.89
5.1# 4-12-4	6.97
5.0# Dried blood	7.00
11.2# Milorganite	7.03
2 in. Manure	7.15
0.4 Sulphur	7.15
2.6 Sulphate of aluminum	7.16
3.3 Sulphate of iron	7.20
2 in. acid peat	7.25

Acid Soil

	Mean pH
Control	5.38
Sulphur	4.64
Sulphate of aluminum	4.68
Ammo.-phos.	4.83
Acid peat	4.83
Sulphate of iron	4.84
Sulphate of ammonia	4.86
5-10-5	4.91
4-12-4	5.01
0-45-0	5.04
Dried blood	4.91
Urea	4.96
Milorganite	4.99
Manure	6.38

In the case of the carbonate soil the first six treatments, on the average, significantly kept the pH of the soil below that of the con-

STEDMAN TYPE "S" POSITIVE MECHANICAL-TRAY VIBRATING SCREENS

Designed especially for screening complete fertilizer. Write for complete illustrated descriptive bulletin No. 502 to solve your screening problems. Six sizes. Capacities 10 to 60 tons per hour.

STEDMAN MANUFACTURES

Batch Mixers
Pan Mixers
Tailings Pulverizers
Revolving Screens
Vibrating Screens
Dust Weigh Hoppers
Acid Weigh Scales
Grinders—Swing Hammer
Cage Mills
Clod Breakers
Mixing Systems
Complete Plants

STEDMAN

STEDMAN'S FOUNDRY & MACHINE WORKS
Founded 1824
503 Indiana Ave., Aurora, Indiana, U.S.A.

• SOUTHERN PHOSPHATE CORPORATION •

Miners of FLORIDA LAND PEBBLE

PHOSPHATE ROCK

— *all commercial grades!*

Plants at Sangully, Pauway, Medulla and Ridgewood, Fla.

MAIN OFFICE • *Baltimore Trust Building* • BALTIMORE, MD.

Tankage
Blood
Bone
All
Ammoniates

Jos. H. SCHMALTZ

BROKER

FERTILIZER MATERIALS

327
South
La Salle
Street
CHICAGO

OFFICIAL BROKER FOR MILORGANITE

MAILING LISTS

GET OUR FREE REFERENCE BOOK *and* MAILING LIST CATALOG FREE

Gives counts and prices on accurate guaranteed mailing lists of all classes of business enterprises in the U. S. Wholesalers—Retailers—Manufacturers by classification and state. Also hundreds of selections of individuals such as professional men, auto owners, income lists, etc.

Write today for your copy

R. L. POLK & CO.
Polk Bldg.—Detroit, Mich.
Branches in Principal Cities
World's Largest City Directory Publishers
Mailing List Compilers. Business Statistics. Producers of Direct Mail Advertising.

For over 20 years we have served the Fertilizer Industry

ACID-PROOF CEMENT
Ready Mixed—For Immediate Use
Packed in 250-lb. Steel Drums
Dry-Packed in 100-lb. Bags

CHEMICAL PUTTY
Stops Acid, Gas and Water Leaks

QUARTZ PEBBLES
Graded to Size

FILTER GRAVEL, FILTER SAND

ACID VALVES

SOUTHERN DISTRIBUTORS OF
CALGON (Sodium Hexametaphosphate)

ACID BRICK, SPIRAL RINGS

Charlotte Chemical Laboratories
INCORPORATED
Laboratories, Plant, Office
CHARLOTTE, N. C.

trol, while the first nine treatments are significant on the acid soil. The organic ammoniates caused a rather sharp rise in pH at the start of the experiment but the final pH values are generally lower than the other treatments. If the final pH values, rather than the mean pH values, were taken as the basis of comparison, the organic ammoniates would stand at the head of the list in effectiveness on both soils. The phosphates were comparatively more effective on the carbonate soil in maintaining a low pH against the alkalizing effect of the hard water.

Some of the important factors influencing the efficient use of fertiiizers and acid-forming substances to neutralize the carbonates added to soils in hard water are: (1) carbonate content and buffer capacity of the soil. Both of these factors will change the order of effectiveness of the treatments; (2) the neutralizing and precipitating effects of the superphosphates on calcium and magnesium salts; (3) the quantity and rate of decomposition of the ammoniates; (4) quantity of acid chemicals used; (5) importance of initial or final pH to the grower; (6) amount of lime carbonate in the water; (7) the pH preference of the plants grown.

The Influence of Potash Fertilization Upon the Yield and Quality of Tomatoes

Jackson B. Hester, Department of Agricultural Research, Campbell Soup Co.

Replaceable potassium is an important factor in tomato production. The method of fertilization with potassium largely controls the results obtained. Direct application of large amounts in the row under the plant may reduce rather than increase the yield. Proper methods of making available large amounts of potassium to the tomato crop greatly improved the yield and quality of tomatoes for canning.

Effect of Temperature of the Alcohol in the Determination of Potash in Fertilizers

C. W. Hughes and O. W. Ford, Purdue University Agricultural Experiment Station, Lafayette, Ind.

Results of the analysis of potash determinations made by the Official Method for Potash in Fertilizers, 43(b), of the Methods of Analysis, A. O. A. C., Fourth Edition, 1935, indicate that the temperature of the acid alcohol and wash alcohol has an appreciable effect upon the solubility of K_2PtCl_6. In addition, a greater solvent action is encountered when the acid and alcohol are added to the K_2PtCl_6 separately than when they are added as a previously mixed solution. The determinations were made at 18° and 38° C.

THE CASE FOR COOPERATIVES

(Continued from page 14)

other sources of farm supplies behave on quality and maintain fair prices.

Mr. Douglass has a good deal to say about alleged tax exemptions. The consumer cooperatives, which I repeat, are no more closely related to farmer cooperatives than is Mr. Douglass' private fertilizer business, enjoy no tax exemptions at the hands of local, state or federal government. They pay all the taxes that Mr. Douglass has to pay.

Virginia farmers do well over half of all of their cooperative buying through the organization for which I speak—Southern States Cooperative. On its fertilizer factory, which is within a stone's throw of that of the Smith-Douglass Company, it pays every tax that Mr. Douglass' company pays. So does it pay all other state and local taxes paid by any other business, including the state income tax.

The sole tax exemption enjoyed by Southern States Cooperative is from Federal income taxes. That, however, is not actually an exemption in the final analysis. Cooperatives operate in the interest of the users of the business. Any earnings are returned in patronage refunds to the users of the business in proportion to their use of it—not to the owners in proportion to their ownership, as is the case with Mr. Douglass' company.

Does Mr. Douglass think it fair that farmers should pay federal income taxes twice on the same income? If the Federal Government assessed the income tax on the savings of farmers cooperative associations, which savings are returned in patronage refunds and are subject to individual income tax, then the income tax would be paid twice.

Cooperation has well been defined as democracy in business. Agricultural cooperation, by helping farmers protect their economic interests and their standard of living, is making an enormously important contribution to our American system and the preservation of our democracy.

Both the Democratic and Republican platforms have declared unequivocally for encouragement by the Federal Government of agricultural cooperation. It would seem safe to assume that the fundamental policy of the Federal Government for a generation, with reference to farmer cooperatives, will not be changed even though it does tend to hold within reasonable limits the profit margins the fertilizer and other industries can exact from hard pressed farmers.

Books on Agriculture and Fertilizers

Commercial Fertilizers

By GILBERT H. COLLINGS, PH.D., Associate Professor of Agronomy, Clemson Agricultural College. A modern, complete study of all fertilizer problems, well illustrated. The book gives actual research data, and the work of many agronomists, chemists and engineers has been reviewed. Each chapter has been read by authorities connected with organizations producing or marketing the products discussed; thus it represents a composite of the best opinions and conclusions in the fertilizer industry. 365 pages. 85 illustrations. Price $4.00.

Handbook of Fertilizers

By A. F. GUSTAFSON, PH.D., Professor of Soil Technology, Cornell University. A revised edition of this popular treatise. Covers the sources, character and composition of fertilizers and fertilizer materials. The food requirements of different crops and the effects of different fertilizers. A valuable volume for fertilizer manufacturers and salesmen, county agents, agricultural teachers, farmers and truckers. 172 pages. 5 x 8. Price $1.75.

Manures and Fertilizers

By H. J. WHEELER. A clear and unusually full discussion of the practical utilization of manures and fertilizers of all kinds and of their relations to the plant and to the soil. 389 pages. 5½ x 7½. Illustrated. Price $2.75.

Phosphoric Acid, Phosphates and Phosphatic Fertilizers

By W. H. WAGGAMAN. A comprehensive treatise, covering completely the subjects of phosphoric acid and phosphate—the sources, the processes of treatment, the products obtained, and their uses in agriculture and the arts. The volatilization process for producing phosphoric acid is fully discussed. In addition to the use of phosphate as a fertilizer material, there are chapters on phosphate baking powders, phosphate water softeners, and miscellaneous uses. This book is one of the American Chemical Society's technologic monographs and contains extended references to the literature, which facilitates further study of the subject. 366 pages. Price $5.75.

Potash Deficiency Symptoms

By OSKAR ECKSTEIN, ALBERT BRUNO AND J. W. TURRENTINE. A revised edition which explains in detail the signs of potash deficiency in all the important cultivated crops as shown in appearance and structure of leaf, root, fruit, etc.; also the influence of a lack of potash on resistance to plant diseases, pests and climatic factors. Printed in English, French and German. Profusely illustrated with 55 color plates and 41 black and white engravings. 248 pages. 7 x 9½. Price $2.25.

Potash: A Review, Estimate and Forecast

By J. W. TURRENTINE, M.S., PH.D., in charge of Potash Investigations, Bureau of Soils, U. S. Department of Agriculture. This book, written by an authority on the subject, covers in detail the American and foreign potash industry. This book deals with the technology of potash manufacture from numerous raw materials; the occurrence, properties and relative values of various potash minerals and the technology of extraction; the technology of utilizing potash-bearing industrial wastes for the manufacture of potash salts. European and other foreign sources of supply are given special attention. 188 pages. 6 x 9. Illustrations and tables. Price $3.00.

Soil Management

By FIRMAN E. BEAR, PH.D. This is a revised and enlarged edition of a book which was an accepted text book in schools with agricultural courses, and which also enjoyed a wide general circulation. The author has made a study of soils for many years, both in this country and in Europe. The 26 chapters cover five divisions of the subject—requirements of soils, characteristics of soils, utilizing soil resources and supplementing soil resources. The last division treats most effectively of fertilizers. 412 pages. 6 x 9. 58 figures. Price $3.50.

Sulphuric Acid Manufacture

By ANDREW M. FAIRLIE. This volume covers thoroughly the production of sulphuric acid from its earliest beginnings to the latest developments in both chamber and contact systems. Modern apparatus, plant construction and production methods are described in detail, with numerous illustrations. Other chapters are also included on the production of raw materials as well as the uses, handling methods, cost accounting methods, etc., of the finished product. An American Chemical Society Monograph. 632 pages. 6 x 9. Price $9.75.

Theory and Practice in the Use of Fertilizers

By FIRMAN E. BEAR, PH.D. Second revised edition, covering the progress in the manufacture and use of fertilizers during recent years. The history of the science of fertilizers from the time of Jethro Tull to the present era. Fertilizer practice, both in Europe and America, is completely examined. The various schemes that have been proposed for determining what fertilizers to use are thoroughly treated. A comparison of fertilizers and their relative values is made. Also, there are concise statements of determining the fertilizer needs, and specific suggestions as to the use of fertilizers. 360 pages. 6 x 9. Price $4.00.

Any of the above sent postpaid on receipt of price. A full list of books on these subjects sent free on request.

WARE BROS. COMPANY

1330 Vine Street - - - - Philadelphia, Pa.

BUYERS' GUIDE

A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AUTOMATIC ELEVATOR TAKEUPS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Paper
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG-CLOSING MACHINES
Bagpak, Inc., New York City.

BAG PILERS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

HENRY L. TAYLOR, *Broker*
Bentley's Code Cable Address "HLTAYLOR"
NORTH CAROLINA BANK BLDG., WILMINGTON, N. C.
Menhaden Fish Products and Fertilizer Materials

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CALCIUM-NITRATE
Synthetic Nitrogen Products Co., New York City.

CAL-NITRO
Synthetic Nitrogen Products Co., New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

CASTINGS—Iron and Steel
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.

CHEMICALS—Continued
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

Andrew M. Fairlie
CHEMICAL ENGINEER
22 Marietta Street Building ATLANTA, GA.
CABLE ADDRESS: "SULFACID ATLANTA"

SULPHURIC Acid Plants . . . Design, Construction, Equipment . . . Operation . . . Mills-Packard Water-Cooled Acid Chambers, Gaillard Acid-Cooled Chambers, Gaillard Acid Dispersers, Contact Process Sulphuric Acid Plants.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DOUBLE SUPERPHOSPHATE (See Superphosphate—Concentrated)

DRYERS—Direct Heat
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Co., Columbus, Ohio.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
U. S. Phosphoric Products Corp., New York City.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Power Transmission
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNESIA
California Chemical Co., New York City.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE AND CARBONATE
Tennessee Corporation, Atlanta, Ga.

MANGANESE SULPHATE
Tennessee Corportion, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Synthetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers and Importers
American Potash and Chem. Corp., New York City.
Potash Co. of America, Baltimore, Md.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

ROUGH AMMONIATES
Bradley & Baker, New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

SCREENS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Snythetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.

SULPHURIC ACID—Continued
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Agricultural Corp., New York City.
U. S. Phosphoric Products Corp., New York City.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland Co., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Snythetic Nitrogen Products Co., New York City.

UREA-AMMONIA LIQUOR
Du Pont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROWS (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

ALPHABETICAL LIST OF ADVERTISERS

For Classified Index, see pages 28 to 32, inclusive

American Agricultural Chemical Co., New York City 3
American Cyanamid Co., New York City..—
American Limestone Co., Knoxville, Tenn. 20
American Potash and Chemical Corp., New York City 4, 23
Armour Fertilizer Works, Atlanta, Ga. 21
Ashcraft-Wilkinson Co., Atlanta, Ga. 4
Atlanta Utility Works, East Point, Ga....—

Bagpak, Inc., New York City .....—
Baker & Bro., H. J., New York City, Front cover, 22
Barrett Company, The, New York City, Back cover
Bemis Bro. Bag Company, St. Louis, Mo. ..—
Bradley & Baker, New York City.....14

Charleston Mining Co., Inc., Richmond, Va.—
Charlotte Chemical Lab., Charlotte, N. C. ..25
Chemical Construction Corp., New York City .....—
Chilean Nitrate Sales Corp., New York City.18

Dougherty, Jr., E., Philadelphia, Pa.....33
DuPont de Nemours & Co., E. I., Wilmington, Del. .....—
Duriron Company, Dayton, Ohio.....—

Fairlie, Andrew M., Atlanta, Ga.....29
Farmers Fertilizer Co., Columbus, Ohio...34

Gascoyne & Co., Inc., Baltimore, Md.....34

Hayward Company, The, New York City..34
Huber Company, L. W., New York City..—
Hydrocarbon Products Co., New York City.17

International Agricultural Corporation, New York City .....2d cover

Jeffrey Manufacturing Co., The, Columbus, Ohio .....—
Jett, Joseph C., Norfolk, Va. 34

Keim, Samuel D., Philadelphia, Pa. 33

Link-Belt Company, Chicago, Ill.....—

Monarch Mfg. Works, Inc., Philadelphia, Pa. 34

Pacific Coast Borax Co., New York City, 2d cover
Polk Co., R. L., Detroit, Mich. 25
Potash Co. of America, Baltimore, Md., 3d cover

Ruhm, H. D., Columbia, Tenn. 34

Sackett & Sons Co., The A. J., Baltimore, Md. .....—
Schmaltz, Jos. H., Chicago, Ill. 25
Shuey & Company, Inc., Savannah, Ga. 34
Smith-Rowland Co., Norfolk, Va.....—
Southern Phosphate Corp., Baltimore, Md. 25
Stedman's Foundry and Machine Works, Aurora, Ind. 24
Stillwell & Gladding, New York City.....34
Synthetic Nitrogen Products Co., New York City .....—

Taylor, Henry L., Wilmington, N. C.....28
Tennessee Corporation, Atlanta, Ga. .....—
Texas Gulf Sulphur Co., New York City..—

U. S. Phosphoric Products Corp., New York City 23
United States Potash Co., New York City..19

Wellmann, William E., Baltimore, Md. 23
Wiley & Company, Inc., Baltimore, Md. 34

SAMUEL D. KEIM

By-Products *and* Fertilizer Materials

(SINCE 1898)

1612 MARKET STREET
PHILADELPHIA, PENNA.

E. DOUGHERTY, JR., Manager

MONARCH
Chamber Sprays

Have replaced other sprays in most plants throughout the world. Made of stoneware. Will not break or crack from temperature changes. Hard lead body and cap.

For Scrubbing Acid Gases

Where acids affect our cast brass or "Everdur" nozzles, Fig. 645, we suggest **Hard Rubber Nozzles.**

See Catalog 6-C

Fig. 6020 **MONARCH MFG. WORKS, INC.**
Westmoreland and Emery Sts., Phila., Pa.

Hayward Buckets

Use this Hayward Class "K" Clam Shell for severe superphosphate digging and handling.
THE HAYWARD CO., 202 Fulton St., New York

GASCOYNE & CO., INC.
Established 1887
Chemists and Assayers
Public Weighers and Samplers
27 South Gay Street - BALTIMORE, MD.

Stillwell & Gladding
Established 1868
WE MAKE ANALYSES OF ALL KINDS
130 Cedar Street :: NEW YORK

The Farmers Fertilizer Co.
Manufacturers
COMPLETE FERTILIZERS
BULK SUPERPHOSPHATE
SULPHURIC ACID
Acid plant capacity, 45,000 tons. Fertilizer plant capacity, 50,000 tons
Get in touch with us. COLUMBUS, OHIO

SHUEY & COMPANY, Inc.
Specialty: Analysis of Fertilizer Materials and Phosphate Rock. Official Chemists for both Florida Hard Rock Phosphate and Pebble Phosphate Export Associations. Official Weigher and Sampler for the National Cottonseed Products Association at Savannah; also Official Chemists for National Cottonseed Products Association.
115 E. BAY STREET, SAVANNAH, GA.

FOR SALE
UP TO 5,000 ACRES OF TENNESSEE
PHOSPHATE LANDS
Mineral Rights or Fee Simple
BEST AND SAFEST PLACE TO INVEST
IDLE MONEY
H. D. RUHM COLUMBIA, TENN.

JETT
BROKER

ALL FERTILIZER MATERIALS

FISH SCRAP for Fertilizer and Fish Meal for Feed, Nitrate of Soda, Sulphate of Ammonia, Potash Salts, Superphosphate (Acid Phosphate), Meals, South American and Domestic Tankage and Blood, Foreign Fish Guano.

JOS. C. JETT
Board of Trade Building
NORFOLK, VA.

WILEY & COMPANY, Inc.
Analytical and Consulting Chemists
BALTIMORE, MD.

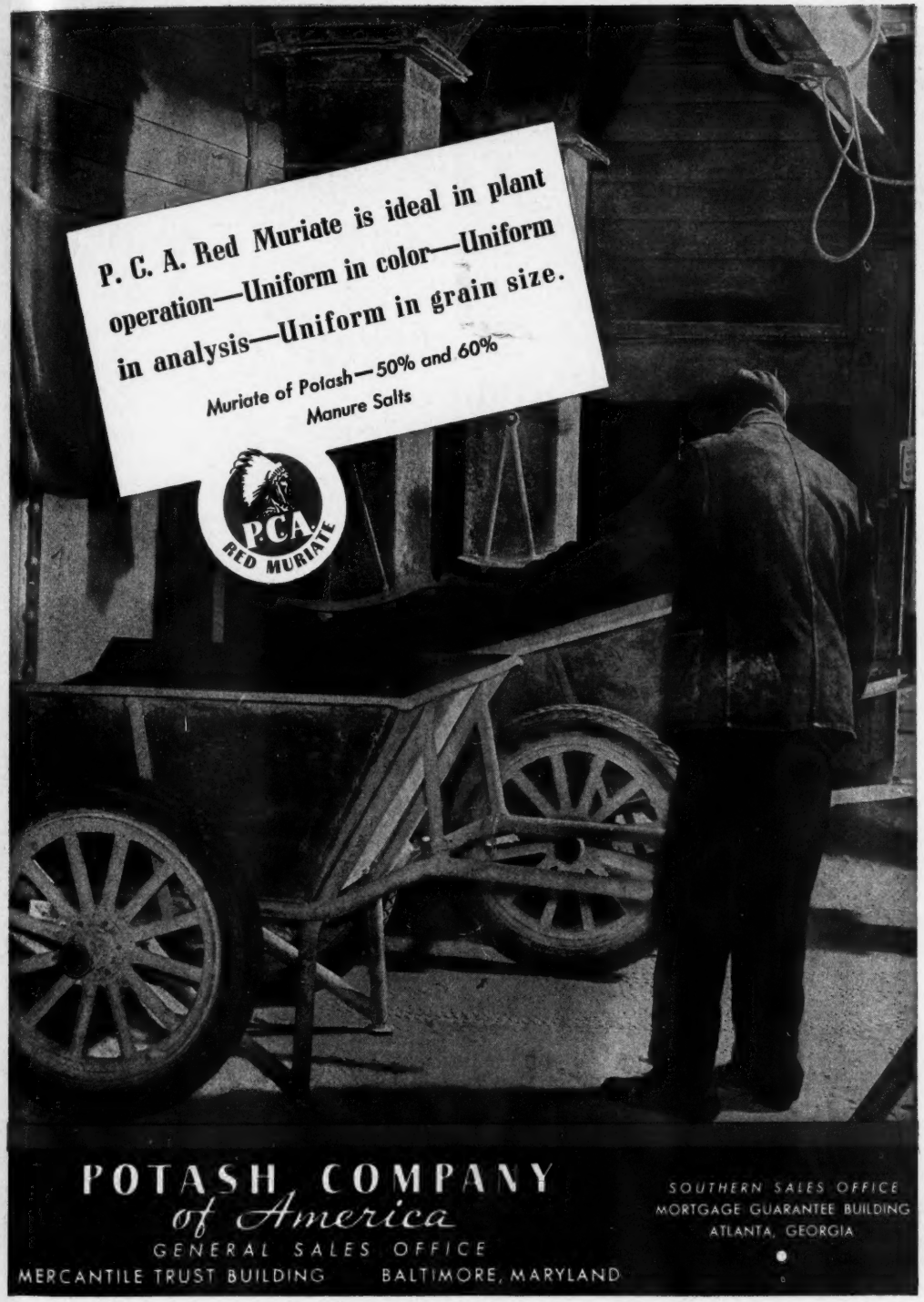
Get the Latest Edition

It defines many new fertilizer terms which have not appeared in any previous edition of the handy

Pocket Dictionary of Fertilizer Materials

Only 50 cents per copy
Special prices on quantity lots

WARE BROS. COMPANY, Publishers, 1330 Vine St., PHILA.


P. C. A. Red Muriate is ideal in plant operation—Uniform in color—Uniform in analysis—Uniform in grain size.
Muriate of Potash—50% and 60% Manure Salts
P.C.A.
RED MURIATE
POTASH COMPANY
of America
GENERAL SALES OFFICE
MERCANTILE TRUST BUILDING BALTIMORE, MARYLAND
SOUTHERN SALES OFFICE
MORTGAGE GUARANTEE BUILDING
ATLANTA, GEORGIA

GOOD HARVESTS are a great basic source of the American way of life. The American pioneer got good harvests by constantly moving to the virgin fertility of vast frontiers. Today America depends upon chemical fertilizers to make old soils new and productive of better living for 130,000,000 people. When these fertilizers are American-made from American materials they build an industry that produces and protects American independence.

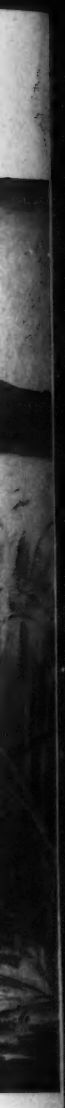
THE BARRETT COMPANY, NEW YORK, N.Y.

HOPEWELL, VA. COLUMBIA, S. C. MONTGOMERY, ALA. MEMPHIS, TENN.
RALEIGH, N. C. ATLANTA, GA. NEW ORLEANS, LA. SAN FRANCISCO, CAL.

Headquarters for American-made Nitrogen

Barrett NITROGEN

BARRETT NITROGEN SOLUTIONS ★ DOMESTIC SULPHATE OF AMMONIA ★ ARCADIAN, THE AMERICAN NITRATE OF SODA



OF SODA